Abstract

In 2014 the Hungarian Government signed an Intergovernmental Agreement with the Russian Federation, for the construction of two VVER-1200 units at the Paks NPP site. The Hungarian Atomic Energy Authority (HAEA) is responsible for the supervision and licensing of nuclear facilities in Hungary. In preparation for the licensing of the new NPP, significant efforts were invested to meet the challenges of such a complex task. Goal of this paper is to summarize the results and lessons learned of this preparatory process from the view of the licensing authority.

1. INTRODUCTION

In January 2014, Hungary signed an Inter-Governmental Agreement with the Russian Federation for the construction of two VVER-1200 units at the Paks site, which currently has four operating units of the VVER-440 type reactor. The new units are expected to start operation around 2026. The agreements have been approved by the Parliament in two consecutive parliamentary terms. Based on the intergovernmental agreements (IGA), three contractual implementation agreements were signed in December 2014, between MVM Paks II Ltd. on the Hungarian side, and JSC NIAEP on the Russian side: the engineering, procurement and construction agreement (EPC), the fuel supply agreement, and the operation and maintenance support agreement.

Before the start of the construction, several permits and licenses must be issued. Hungary has a decentralized regulatory system, where the Hungarian Atomic Energy Authority (HAEA) is responsible for the oversight of nuclear safety, security and safeguards, whilst the Government Office of Baranya County is responsible for environmental issues.

Authorisation for site investigation and evaluation for the Paks II project company was given by HAEA in 2014. Execution of the site investigation program started in 2015. A site license application was submitted in October 2016, which was approved in March 2017 by HAEA. The construction license application is expected to be submitted in 2018.

Regarding the environmental permitting several forums were held in the region of the site, and – in line with the Espoo Convention – nine international hearings in seven neighbouring countries were conducted in September-November 2015. The Environmental Authority has issued the environmental permit in 2016, which was appealed by NGOs. Second-degree permit review concluded in April 2017 and reaffirmed the earlier environmental permit.

2. CHALLENGES AND LESSONS LEARNED

The construction of a nuclear power plant is a major, long-lasting project, which represents a challenge for all involved parties. The early phases of Hungary’s NPP construction project have been running for several years now, and it focused on preparations. During these efforts HAEA initiated the review of the Hungarian legislation regarding nuclear power plants. Because of this review, significant changes to the legislation have been implemented.

After the Fukushima-Daiichi accident international safety standards have been improved. This introduced several new elements into already exiting concepts (e.g. practical elimination). To incorporate these new elements into the national legislations, they had to be interpreted, and detailed into safety requirements – including quantitative engineering criteria – whilst maintaining the “technological neutrality” of the legislations. The following chapters summarizes some of the experiences and results of this process.
2.1. Differentiation of requirements for existing and new units

The Hungarian Act on Atomic Energy states that regulatory requirements should be reviewed every 5 years, and in cases where significant new safety issues arise. A periodic review was performed in 2011, and an extraordinary post-Fukushima review was conducted in 2013-2014. During these reviews HAEA faced several challenges. First, based on lessons learned from recent construction projects (e.g. Olkiluoto 3) it was deemed necessary to prepare detailed QA/QC/QM and specific management system requirements for the design and construction processes, and for the organisational capabilities of the licensee (e.g. intelligent customer\(^1\) capability). Second, the lessons learned from the Fukushima accident had to be incorporated into the legal requirements.

As a result of the above-mentioned reviews, the detailed and technical level requirements were implemented into the Nuclear Safety Codes (NSC). Design and construction process specific management system requirements were incorporated into Vol. 9 of the NSC (see FIG. 1.).

Incorporation of the lessons learned from the Fukushima accident was a difficult task, because at the time of the review (2013-2014), only high-level recommendations existed (e.g. ‘large releases should be practically eliminated’, etc.). HAEA’s challenge, together with other stakeholders, was to ‘interpret’ these high-level recommendations, and create detailed engineering and acceptance criteria for them.

After careful analysis it was determined, that it is not beneficial to create universal safety requirements that are applicable for both existing (Gen II) and newly constructed (Gen III+) units. Based on this, it was decided, to separately create and/or update requirements for existing and new units (show as Vol 3 and Vol 3A. on FIG. 1.). This separation allowed to implement new concepts and stricter requirements for the new units. For instance, the updated Defence-in-Depth principle as shown in Ref. [1] was implemented in Vol. 3A. of the NSC. Also, the exceedance frequency values for natural hazards to be considered in design basis is stricter; \(10^{-4}/\text{a}\) for existing units (in line with Reference Level T4.2 of Ref [2]), \(10^{-5}/\text{a}\) for new units.

![FIG. 1. - Structure of the Nuclear Safety Codes (NSC)](image)

Based on HAEA’s experience, and feedback from the stakeholders the decision to separate requirements for existing and new units is considered beneficial, because it allows easier interpretation of requirements for the

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\(^1\) As an intelligent customer, in the context of nuclear safety, the management of the facility should know what is required, should fully understand the need for a contractor’s services, should specify requirements, should supervise the work and should technically review the output before, during and after implementation. The concept of intelligent customer relates to the attributes of an organisation rather than the capabilities of individual post holders.
licensurees, and it also helps HAEA to take greater advantage of the graded approach during its oversight activities.

2.2. Specific requirements and guidance for the design and construction phase

As mentioned in the previous chapters, the need for more detailed requirements and guidance regarding the design and construction phases of the project was identified. Besides the incorporation of lessons learned for nuclear power plant projects (e.g. Olkiluoto 3), several other areas required attention. A few examples:

(a) Design adaptation: nuclear power plant vendors generally use the codes and standards of their country of origin, but within the EU some areas have mandatory codes and standards as well (e.g. civil construction code). To harmonize and/or unify design requirements, as well as codes and standards, a design adaptation process has to be developed and implemented by the licensee. The rules of this process have been established in Vol. 9 of the NSC, and in the corresponding regulatory guide.

(b) Supply chain management: based on lessons learned from other projects, it was deemed necessary to enhance supply chain management requirement for the design and construction phases. For instance, the licensee is required to oversee the whole supply chain, down to the lowest tiers, and they must ensure that every supplier doing a safety related activity has a task-specific nuclear qualification.

(c) Safety of neighbouring nuclear facilities: the new units will be constructed next to the operating units. To ensure the safety of the operating units, several design (e.g. crane placement) and construction (e.g. mandatory risk assessment of on-site construction activities before their commencement) requirements have been established. One in particularly interesting challenge is the emergency preparedness of the construction site, because in case of a nuclear emergency at the operating units, a peak number of c.a. 7000 workers must be evacuated from the construction site.

To solve issues like the one mentioned above, a continuous cooperation with all involved parties is necessary, both on management and expert level. Based on HAEA experience, this process is easier if the requirements and the associated regulatory guides are sufficiently detailed.

2.3. Requirement management

As a result of the requirement review shown in the previous chapters, the number of legally binding requirements and the areas covered by regulatory guidelines has significantly increased. Currently legal requirements relevant for HAEA’s scope of work contains more than 10000 paragraphs, ranging from high-level requirements to specific technical requirements. Managing such a large amount of information, especially in terms of connections and interfaces represents a great challenge.

To increase efficiency of information handling, and to ensure a common understanding of requirements by staff members a project has been established within HAEA to implement a special software tool for requirement management. It was determined that there are suitable commercial software products (e.g. used by the aerospace industry) available on the market which could be customized for HAEA’s specific needs.

One of the main expectations is, that the software tool should have specific features for benchmark and gap-analysis activities. This feature is necessary, firstly because the number of international recommendation and legally binding requirements significantly increased after the Fukushima accident, secondly it represents a challenge to ensure consistency with both the original text, but also with other parts of the Hungarian legal document under assessment.

The need for requirement management was also established by the licensee of the new units. Although the scope of requirements is different in some elements, the fundamental issue is the same. With that in mind, HAEA works together with the licensee to coordinate the development, and to ensure that the requirement management system of the licensee and HAEA could interface with each other.

2.4. Number of licensing steps

During the review process mentioned in the previous chapters, the licensing model was also evaluated. Several aspects were considered, such as: administrative workload; possibilities to oversee and enforce nuclear
safety requirements during the design and construction phases; safety considerations for nuclear facilities affected by the construction activities; etc.

After consulting with stakeholders, in terms of facility level major licencing, a multi-step licencing model has been established as shown in FIG. 2. The first two step have already been taken (see Introduction).

![FIG. 2. - Major licensing milestones (nuclear safety related)](image)

Although the multi-step licencing model shown in FIG. 2. has certain disadvantage, like putting extra administrative workload on the licensee and the regulator, it also has advantages in terms of safety, for example:

(a) It ensures the early involvement of the regulator in the construction project, and safety related issue can be identified by them in a timely manner.

(b) The licensee gets certain assurances by receiving a licence at major milestones; it reaffirms that regulatory requirements are met. With this multi-level licencing model, the risks associated with regulatory approval processes are distributed over several phases of the project, which enables easier management of these risk, and allows a better use of the graded approach.

(c) When the very first licence is granted, the applicant becomes a nuclear licence holder, which means they have to meet legally binding nuclear safety requirements relevant for that phase of the project. For instance, relevant management system and leadership requirements based on Ref. [3] should be met even before the start of the site investigation and evaluation. This ensures that the nuclear safety is paramount early on.

(d) As a result of point (c), HAEA has the legal right to supervise the licensees’ activities, and enforce nuclear safety requirements.

(e) At every facility level licensing step, HAEA is required by law to make a public hearing, where citizens and NGOs can express their opinions and concerns. With the multi-step model shown in FIG. 2, a public hearing is held at each major project milestone, which enables enhanced public involvement in the regulatory decision-making process.

Based on HAEA experience so far, the positive effects of such a multi-step licensing outweighs the disadvantages.

REFERENCES

